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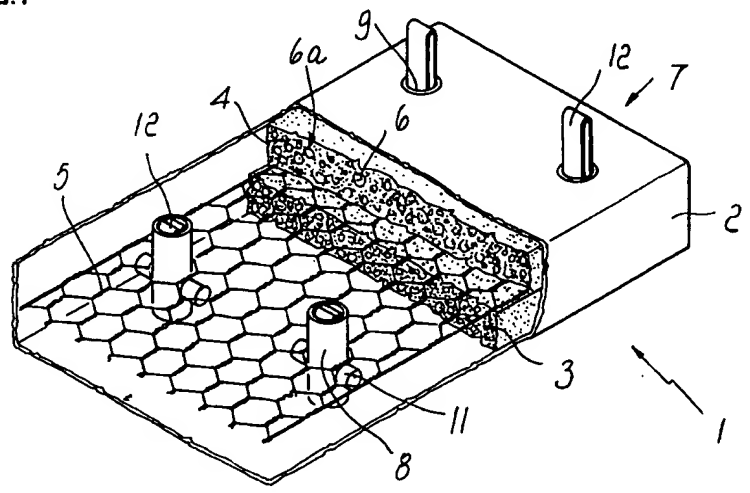
(54) Method for manufacturing a flexible mat-like component for protecting, ballasting and supporting submarine pipelines and cables, and component obtained with the method

(57) A method for manufacturing a flexible mat-like component (1) for protecting, ballasting and supporting submarine pipelines and cables, comprises the following steps: lining with a case (2) the internal space of a component forming box; positioning, inside the internal space thus lined, a wire net (5) reinforcement frame which lies on an intermediate plane parallel to the bottom of the space; introducing in the space a hot premixed filler material (6,6a), composed of a rock aggregate (6) whose dimensions are such that it passes through the meshes of the net and of an asphalt cement (6a), until a level equal to the final thickness of the component is reached, embedding the frame; and covering the filler material with the case.

FIG.1



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Description

The present invention relates to a method for manufacturing a flexible mat-like component for protecting, ballasting and supporting submarine pipelines and cables and to a component obtained therewith.

Components for the specified purpose are already known; they are constituted by a wire net gabion which contains rocks or pebbles subsequently embedded in asphalt cement and is wrapped in a fabric case. These components have lifting elements for handling and installing them.

Conventional components of the above type have some substantial drawbacks, including the limited plasticity of the structure, due to the presence of a double reinforcement net in addition to the considerable dimensions of the rocks to allow subsequent complete filling of voids with the asphalt cement, the onerous work to form the gabion for containing the rocks and pebbles, and the need to provide protections to prevent the metal parts of the component from making contact with the pipelines, triggering galvanic corrosion.

Components are also known which are formed with a bituminous mix which contains gravel pieces measuring no more than approximately 15 mm; however, they have the drawback that when stressed by concentrated permanent loads they deform very slowly but indefinitely, consequently compromising the durability of the component.

The aim of the present invention is to provide a method for manufacturing a mat-like component which is capable of obviating the above-described drawbacks of conventional components.

This aim is achieved with a method for manufacturing a flexible mat-like component for protecting, ballasting and supporting submarine pipelines and cables, characterized in that it comprises the following steps: lining with a case the internal space of a component forming box; positioning, inside said internal space thus lined, a wire net reinforcement frame which lies on an intermediate plane parallel to the bottom of said space; introducing in said space a premixed filler material, composed of a rock aggregate whose dimensions are such that it passes through the meshes of said net and of an asphalt cement, until the set final level is reached, embedding said frame; and covering said filler material with said case.

Within the scope of this aim, an object of the present invention is to provide a flexible mat-like component for protecting, ballasting and supporting submarine pipelines and cables obtained with the above method, which is characterized in that it comprises: a single layer of a filler material which is premixed while hot and is composed of rocky material which is premixed while hot with an asphalt cement which allows a certain flexibility of said layer; a wire net reinforcement frame, arranged substantially in the central plane of said layer; a case which surrounds said layer and is rigidly coupled thereto; and elements for lifting said component which are anchored to said reinforcement frame.

Further characteristics and advantages of the present invention will become apparent from the following description of a preferred embodiment, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a partially sectional perspective view of a component according to the present invention;
Figure 2 is a sectional view of an element for lifting the component;
Figure 3 is a sectional view of a lifting element of Figure 2, rotated by 90° ;
Figure 4 is a sectional view of the component of Figure 1, arranged so as to straddle a pipeline;
Figure 5 is a partially sectional perspective view of a different embodiment of the component according to the invention;
Figure 6 is a partially sectional perspective view of a different embodiment which comprises the stacking of two components according to the invention;
Figure 7 is a sectional view of the element of Figure 6, arranged so as to straddle a pipeline;
Figure 8 is a sectional view of a lifting element according to another embodiment;
Figure 9 is a sectional view of the lifting element of Figure 8, rotated by 90°; and
Figure 10 is a plan view of the lifting element of Figures 8 and 9.

In the figures, the reference numeral 1 generally designates the flexible component according to the invention. Said component is constituted by an outer case 2 which is advantageously constituted, for example, by a geotextile fabric. Inside the case 2 a layer of a filler material is provided which, for the sake of convenience in description, is assumed to be ideally divided into two layers 3 and 4. A reinforcement frame 5, made of wire net or of another sufficiently strong material, is embedded between the layers 3 and 4. The layers 3 and 4 have substantially the same thickness so that the net 5 lies on a plane coinciding with the central plane of the component, is co-planar to the upper and lower faces and coincides with the neutral plane whereon no tension and compression stresses are present when the component flexes.

Advantageously, the net 5 is constituted by a net with double-twist hexagonal meshes which, in order to achieve reduced elongation, are orientated so that the mesh portions formed by the twisted wires form the longitudinal direction of the component.

The filler material is preferably constituted by a rock aggregate 6 with medium piece size, premixed while hot with asphalt cement 6a of the hydraulic type which has a fluid consistency at a temperature of 150-180°C, while the mixture with the rock aggregate has a consistency which tends to self-level and then becomes plastics at

ambient temperature and at the temperatures used on sea floors.

The method for manufacturing the component entails introducing the filler material, which has already been mixed while hot with adapted equipment all at once, in a rectangular prism-like forming box which is internally lined with a fabric case and in which a wire net reinforcement frame has been positioned beforehand halfway along its vertical extension.

The frame has meshes whose dimensions allow the rock aggregate to pass through it, together with the cement, in order to first fill the part of the forming box that lies below the frame and then the part that lies above said frame.

The rock aggregate gives the component, after installation, the ability to withstand impacts, such as the accidental dropping of an anchor, and to withstand the formation of impressions if subjected to permanent loads, in addition to giving it a high relative density which is useful for ballasting pipelines.

Flexibility is thus improved considerably with respect to conventional components and the structure is more uniform and compact. During the manufacture of the component, the entire asphalt mix (rock aggregate and asphalt cement) is in fact poured while hot into the container, avoiding the formation of residual voids, while after laying and leveling, until the mix has cooled enough, a slight flow towards the surface of the asphalt cement allows to form an upper surface which is capable of bonding with the outer case.

In a preferred embodiment, the rock aggregate that composes the filler material constitutes 40-50% of the volume of the component and the rest is constituted by the asphalt cement.

Preferably, the rock aggregate is formed by round calcareous gravel having a piece size of 30-40 mm, in any case not greater than the size of the mesh of the wire net.

By way of example, the asphalt cement to be used to bind the rock aggregate can have a composition including 67-74% by weight of sand and sand mix with 0 to 3 mm grain size; 10-15% by weight of a calcareous filler (Portland cement, hydrated lime, calcareous powder); 16-20% by weight of a binder which is constituted by bitumen which has a variable penetration according to the situations or is modified with plastomers and elastomers or receives the addition of any adapted material.

In order to facilitate the flexibility of the component, its thickness, which is equal to the sum of the layers 3 and 4, should conveniently not exceed 25-30 cm.

It should be observed that the reinforcement frame arranged on the central plane can be constituted by two or more nets of any material, provided that it is sufficiently flexible and strong.

In order to allow transport, handling and installation, the component is provided with a plurality of lifting elements 7.

Each element is composed of a segment of rubber tube 8 whose diameter is such that it passes through the net 5. The tube 8 rests on the lower face of the case 2 and its top protrudes through an opening 9 of the upper face of said case.

Two diametrically opposite holes 10 are formed in the portion of the tube 8 that remains embedded in the lower layer 3 arranged below the net 5; a piece of tube 11 is driven through said holes, acts as a retention pin and is tangent to the mesh 5 in an upward region.

A flexible belt 12 is passed around the portion of the retention pin 11 that lies inside the tube 8; said belt is made for example of fibers or the like, is closed in a loop and is folded so as to fit inside the tube 8 when the component is being formed.

As shown in Figure 1, the belts 12 can be extracted from the tube 8 and thus provide coupling points for lifting hooks by means of which the component can be handled during transport and installation.

It is evident that the described component perfectly achieves the intended aim and objects. In particular, the bituminous mix gives the component considerable flexibility and plasticity, which allow it to wrap around the pipeline or cables in order to protect them or secure them to sea floors. As shown in Figure 4, once the component has been deposited onto the pipeline to be ballasted and protected, it flexes and mates with the shape of the pipeline due to its own weight.

Figure 5 illustrates an embodiment in which a stress distribution element, constituted for example by a square portion of electrically welded net 13, is interposed between the tube portion 11 and the net 5 at the lifting elements.

When the thickness required is considerably greater due to weight reasons, it is possible to stack two components in a single structure. In this case, as shown in Figures 6 and 7, the upper component has two tube segments 14 made of rubber-like material to allow the passage of the loops 12.

The lifting elements are often required not to have protruding parts in which fishing nets, particularly of the trawl type, might catch when the component is submerged on the sea floor and straddles a pipeline.

Figures 8-10 illustrate a solution to this problem which entails anchoring, in the layers 3 and 4, an element which is composed of a plate 15 from which two parallel plates 16 and 17 rise; a flat tubular rubber segment 19 is fixed between said plates by means of a retention pin 18. A metal ring 20 is coupled to the retention pin 18 inside the segment 19, at the upper layer 4. The ring 20 is capable of assuming a position which is internal or external with respect to the tubular segment 19. In the internal position, it rests on the retention pin 18 and is fully recessed in the component, so that it does not offer catching points of any kind. In the external position, the ring 20 protrudes from the tubular segment 19 so that it can be engaged by lifting hooks.

Where technical features mentioned in any claim are followed by reference signs, those reference signs

have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A method for manufacturing a flexible mat-like component (1) for protecting, ballasting and supporting submarine pipelines and cables, characterized in that it comprises the following steps: lining with a case (2) the internal space of a component forming box; positioning, inside said internal space thus lined, a wire net reinforcement frame (5) which lies on an intermediate plane parallel to the bottom of said space; introducing in said space a premixed filler material (3, 4), composed of a rock aggregate (6) whose dimensions are such that it passes through the meshes of said net and of an asphalt cement (6a), until a level equal to the final thickness of the component is reached, embedding said frame (5); and covering said filler material with said case.

2. A flexible mat-like component for protecting, ballasting and supporting submarine pipelines and cables, obtained with the method according to claim 1, characterized in that it comprises: a layer (3, 4) of a filler material, which is composed of rocky material (6) premixed while hot with an asphalt cement (6a) which is adapted to allow a certain flexibility of said layer; a wire net reinforcement frame (5) which is arranged substantially on the central plane of said layer; a case (2) which wraps around said layer and is rigidly coupled thereto; and elements (12) for lifting said component which are anchored to said reinforcement frame.

3. A component according to claim 2, characterized in that said rock aggregate (6) is formed by round calcareous gravel with a piece size of 30-40 mm.

4. A component according to one of claims 2 and 3, characterized in that the asphalt cement used (6a) has a composition which includes: 67-74% by weight of sand and sand mix with 0 to 3 mm grain size; 10-15% by weight of a calcareous fuller (Portland cement, hydrated lime, calcareous powder); and 16-20% by weight of a binder constituted by bitumen.

5. A component according to one of claims 2-4, characterized in that said lifting element is composed of a rubber tube segment (8) whose diameter allows it to pass through the wire net (5) and whose top end opens onto the upper face of said case (2), two diametrically opposite holes (10) being provided in the portion of said tube that remains embedded in said lower layer, a portion of tube (11) which acts as retention pin being driven through said holes, said retention pin being tangent to said net (5) in an upward region, a flexible belt (12) being guided around said retention pin, said belt being closed in a loop and being adapted to be folded so as to be accommodated inside said tube (8) when the component (1) is being formed.

6. A component according to one of claims 2-5, characterized in that it entails interposing, between the tube portion (11) that acts as retention pin and said net (5), a stress distribution element (13) constituted for example by an electrically welded net.

7. A component according to one of claims 2-6, characterized in that when two components are stacked, the upper component has tube portions (14) made of rubberlike material in order to allow the passage of the lifting rings (12).

8. A component according to one of claims 2 to 5, characterized in that said lifting element comprises a tubular segment (19) made of rubber which is connected to an anchoring plate (15), is embedded in said layers (3, 4) and crossed by a retention pin (18) whereto a metal ring (20) is coupled, said ring (20) being able to assume an inactive position, which lies inside the tubular segment (19) and in which it rests on the retention pin (18) and is fully recessed in the component, and an external position, in which the ring protrudes from the tubular segment (19) so that it can be engaged by lifting hooks.

9. A method according to claim 1, characterized in that the bituminous filler mix is used at a temperature of 150-180°.

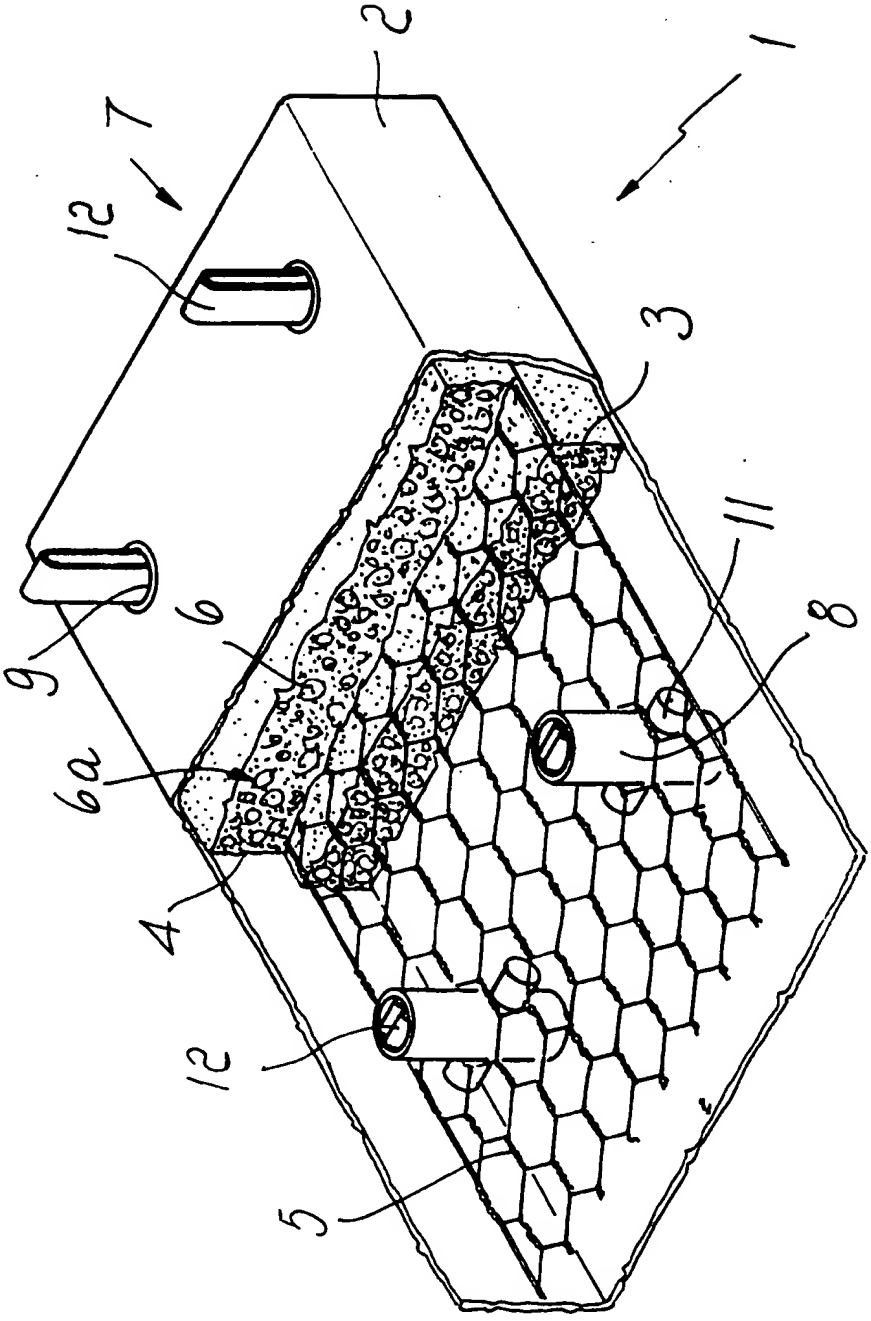


FIG.1

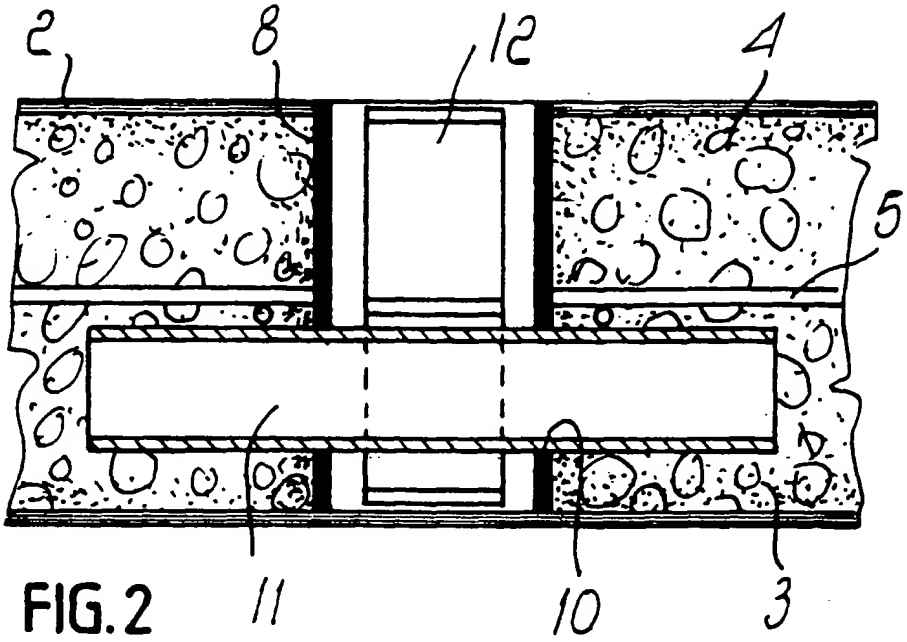
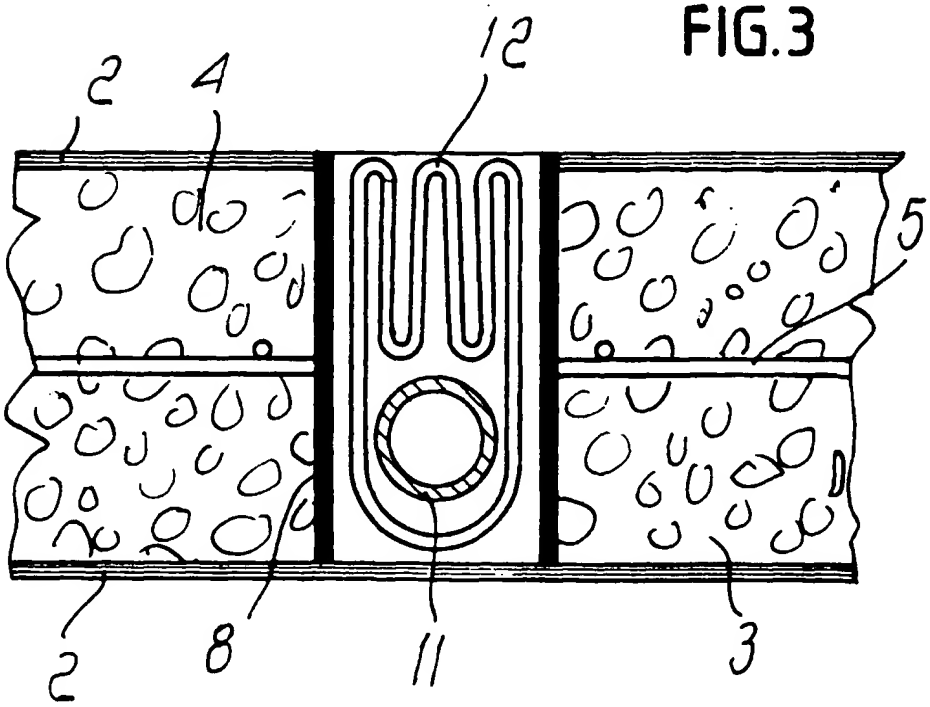


FIG. 2

FIG. 3



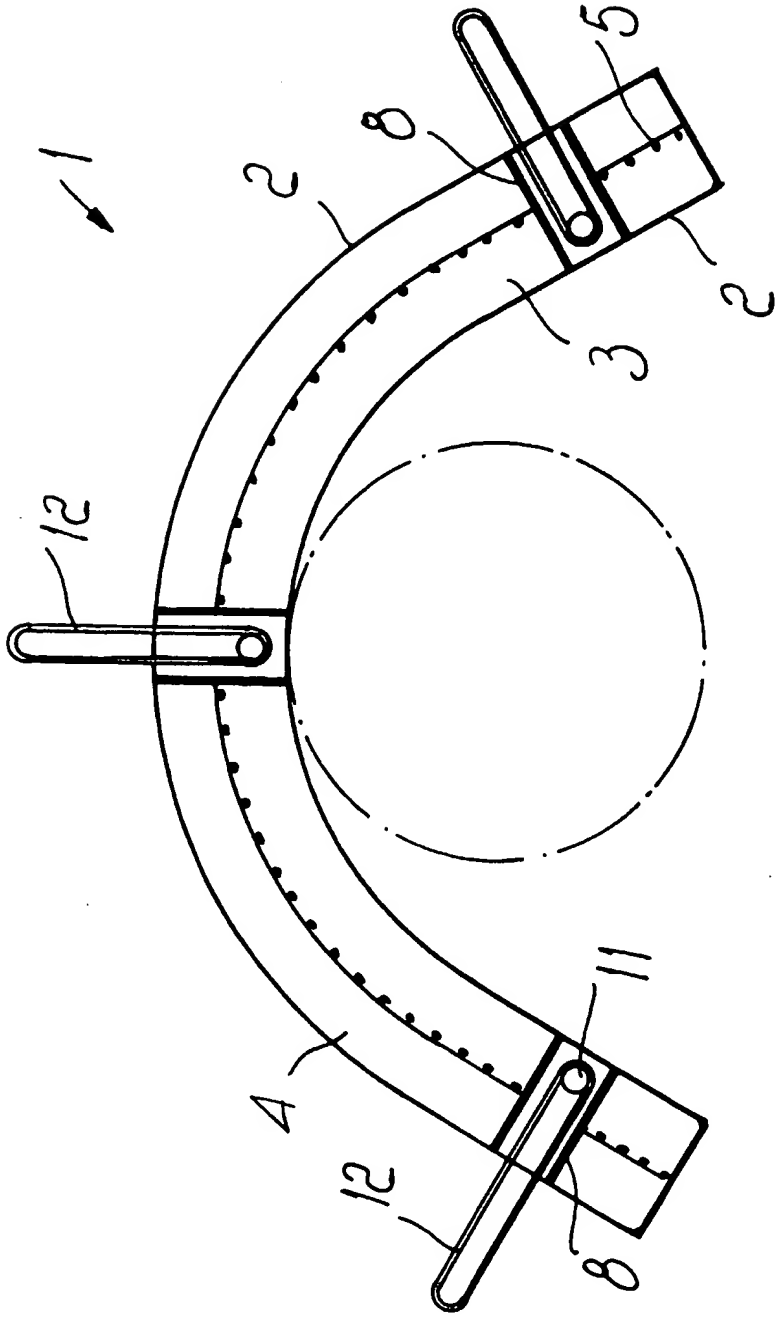


FIG.4

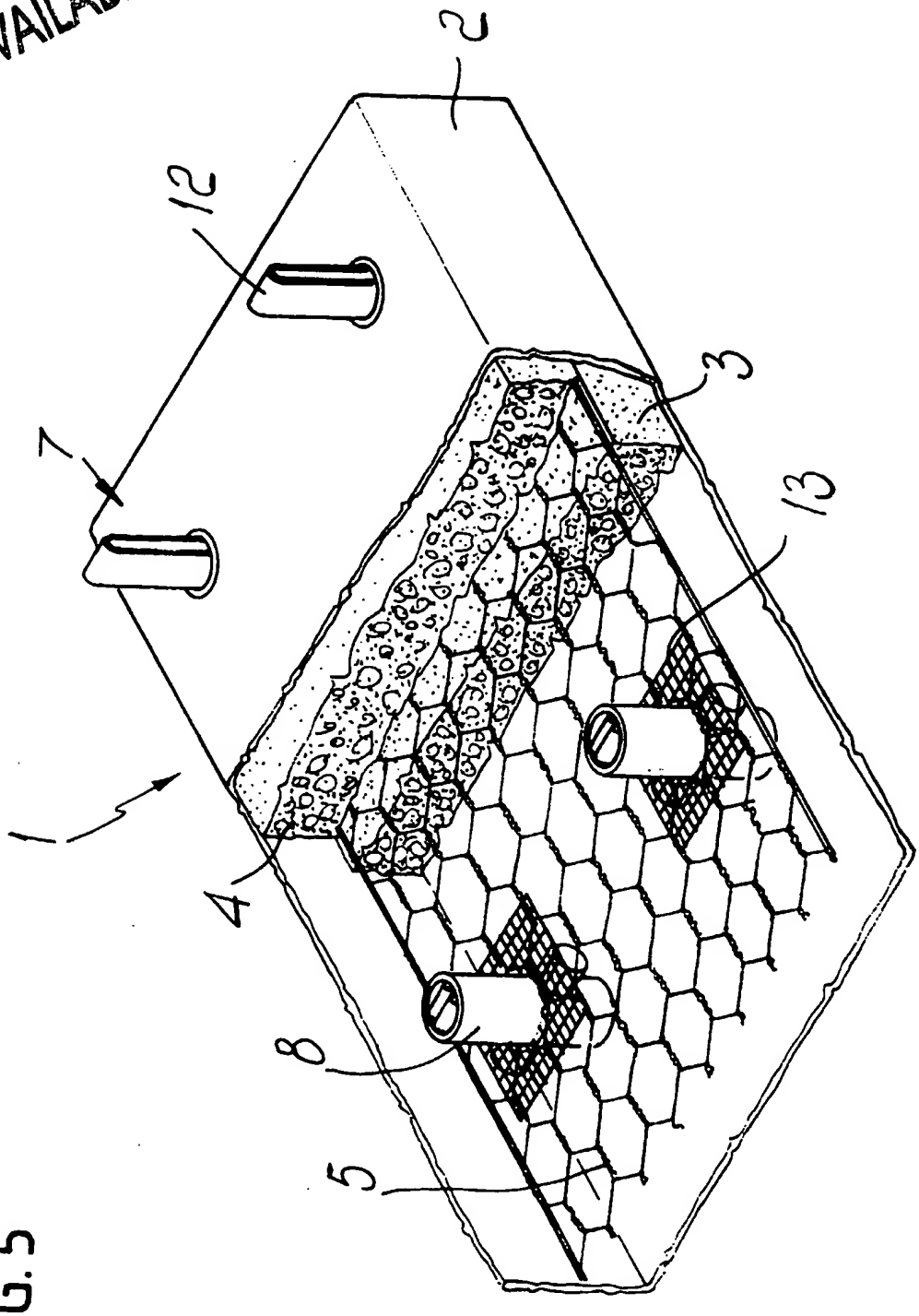


FIG. 5

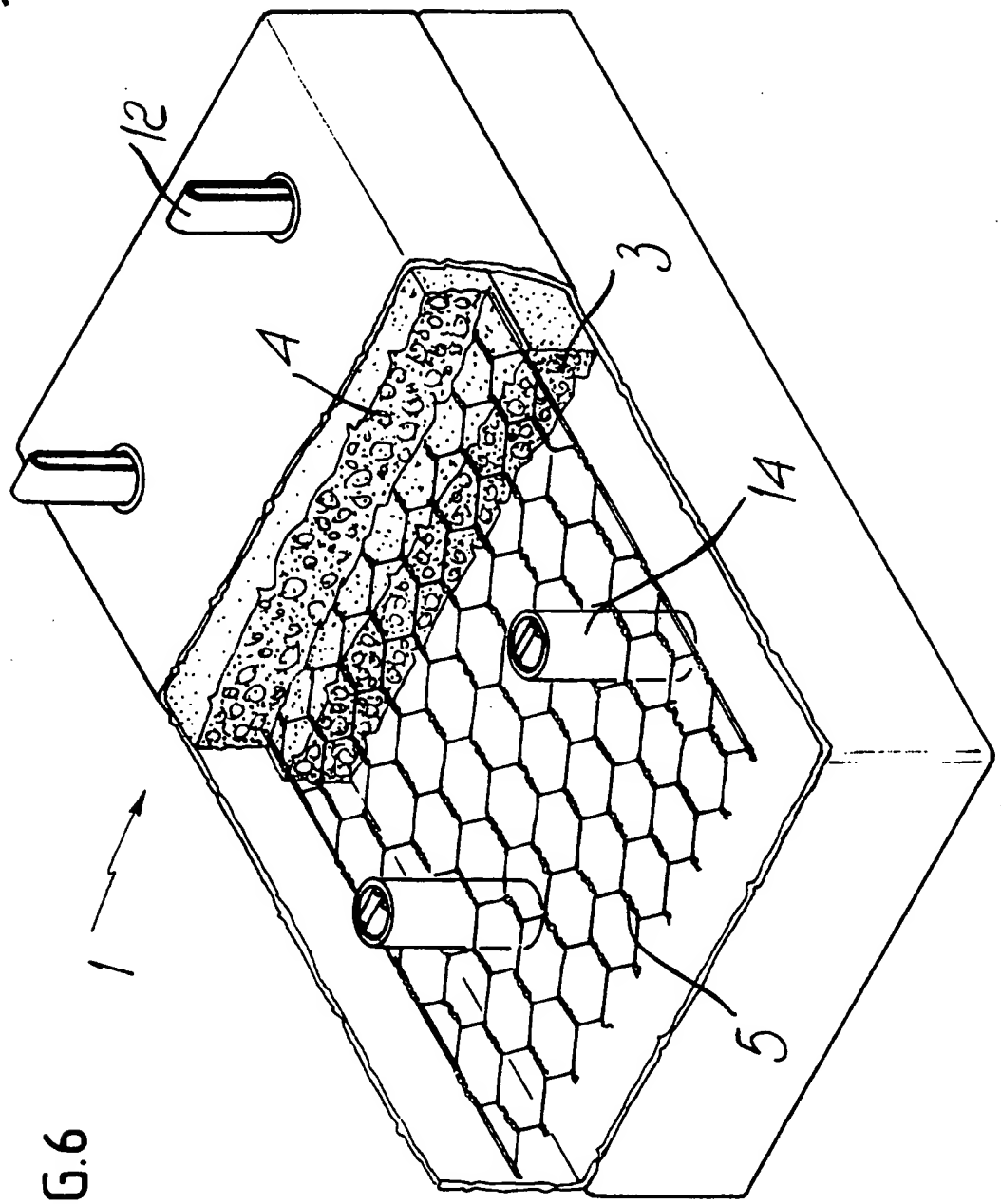


FIG.6

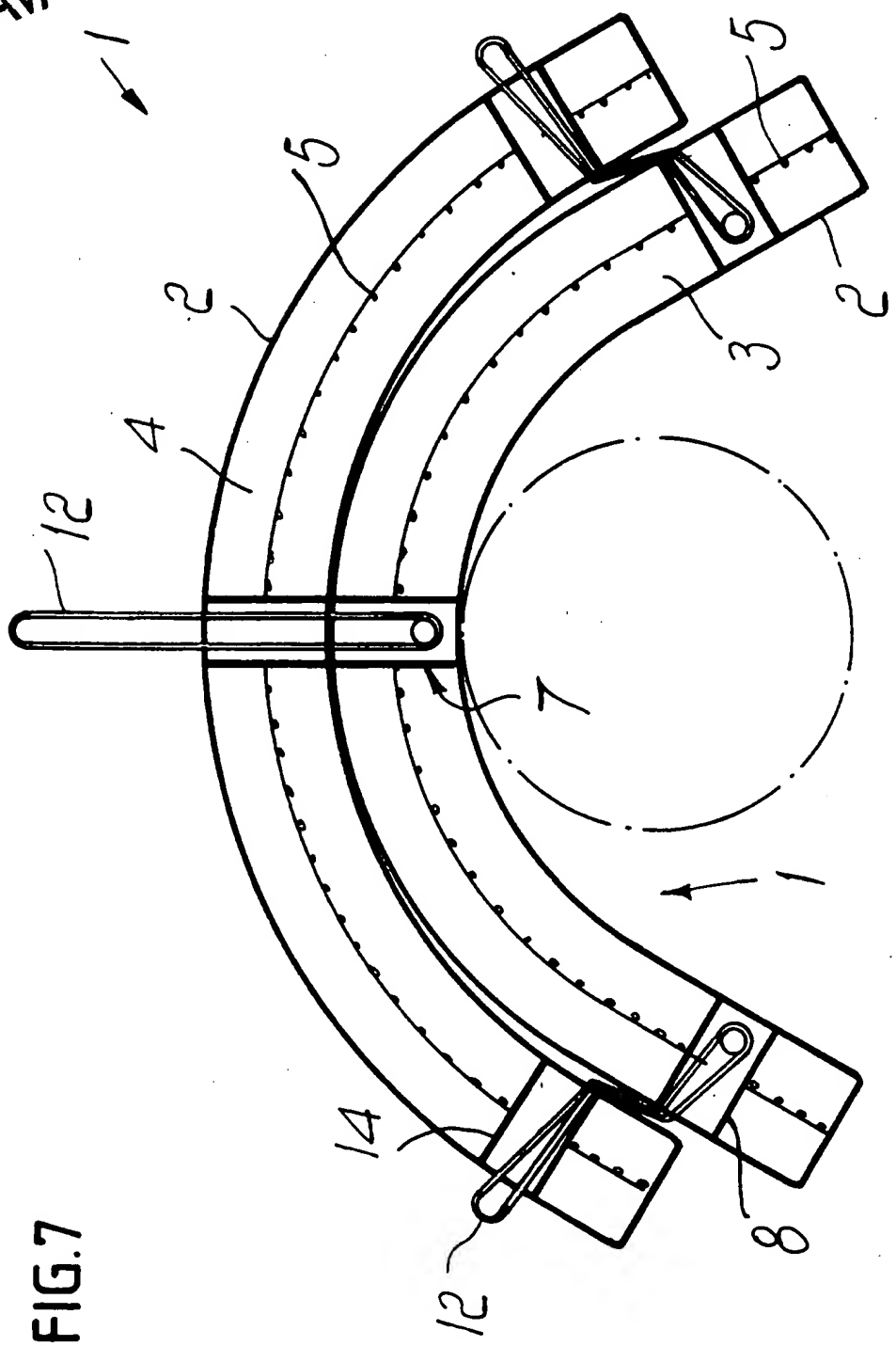


FIG.7

FIG. 8

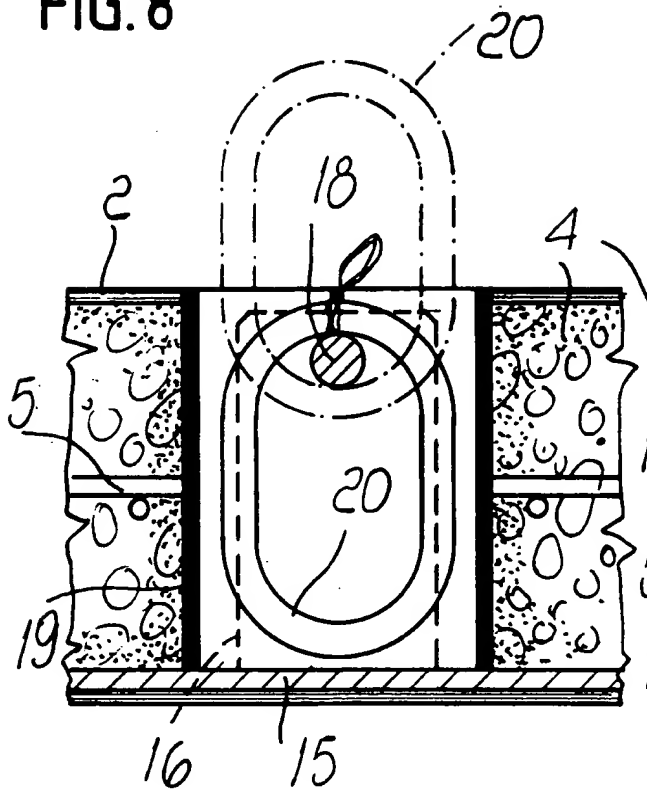
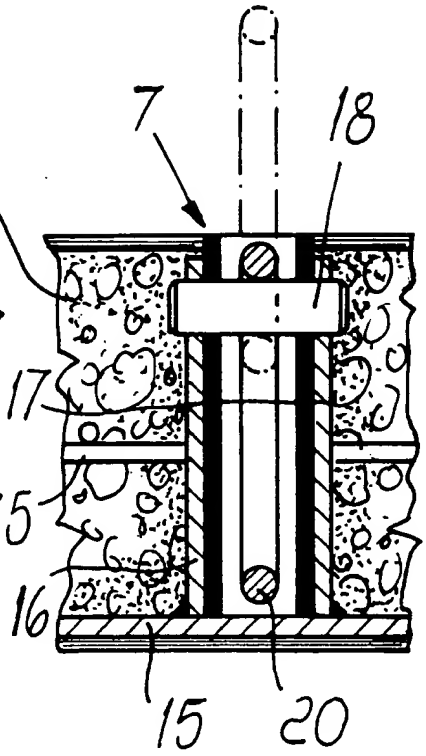


FIG. 9



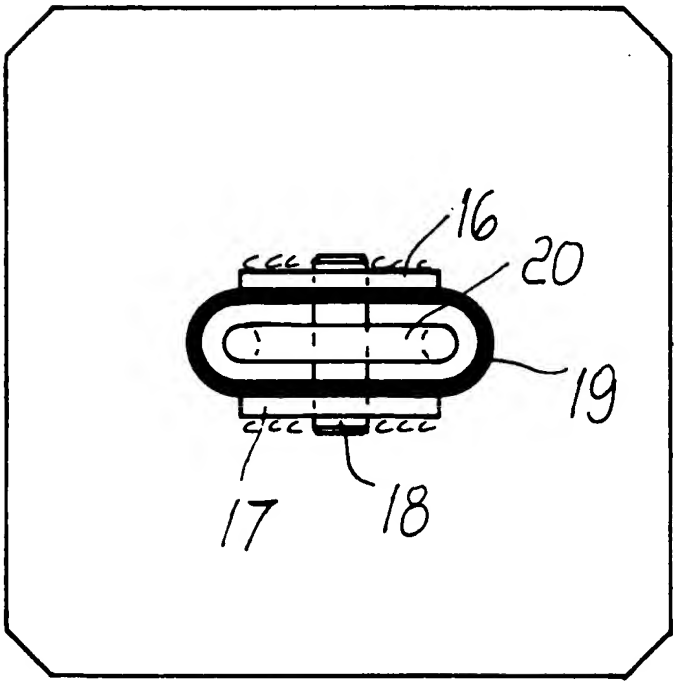


FIG.10

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EUROPEAN SEARCH REPORT

Application Number
EP 98 10 9467

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	GB 1 276 468 A (SEA AND LAND PIPELINES LTD.) 1 June 1972	2,9	E02D1/00 E02D17/20
A	* the whole document *	1,3,4	F16L1/24
Y	US 4 477 206 A (PAPETTI ANDREA ET AL) 16 October 1984	2,9	
A	* the whole document *	3,4	
A	GB 1 435 123 A (SEA LAND PIPELINES LTD) 12 May 1976 * the whole document *	1,2	
A	GB 1 463 743 A (BRITISH PETROLEUM CO) 9 February 1977 * the whole document *	1,2	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

E02D
E02B
F16L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	8 September 1998	Blommaert, S

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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